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Nagata

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(54) **IMAGE HEATING APPARATUS**

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G03G 15/20 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/2039*** (2013.01)

(58) **Field of Classification Search**
CPC G03G 15/2039
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,224,922	B2	5/2007	Kemmochi	
8,831,492	B2	9/2014	Nagata	
8,913,936	B2	12/2014	Takada et al.	
8,923,738	B2	12/2014	Nagata	
2005/0185978	A1	8/2005	Kemmochi	
2012/0213539	A1*	8/2012	Maruko	G03G 15/2025 399/67
2013/0308966	A1	11/2013	Masuda et al.	
2015/0104205	A1*	4/2015	Moteki	G03G 15/2053 399/43
2015/0212465	A1*	7/2015	Momma	G03G 15/2017 399/67

FOREIGN PATENT DOCUMENTS

JP	2005-266785	9/2005
JP	2007-256369	10/2007
JP	2013-242398	5/2015

* cited by examiner

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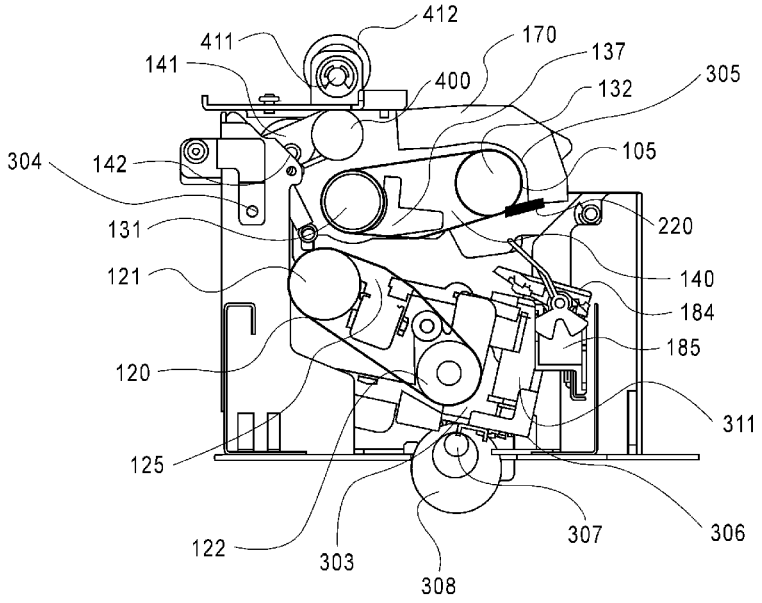
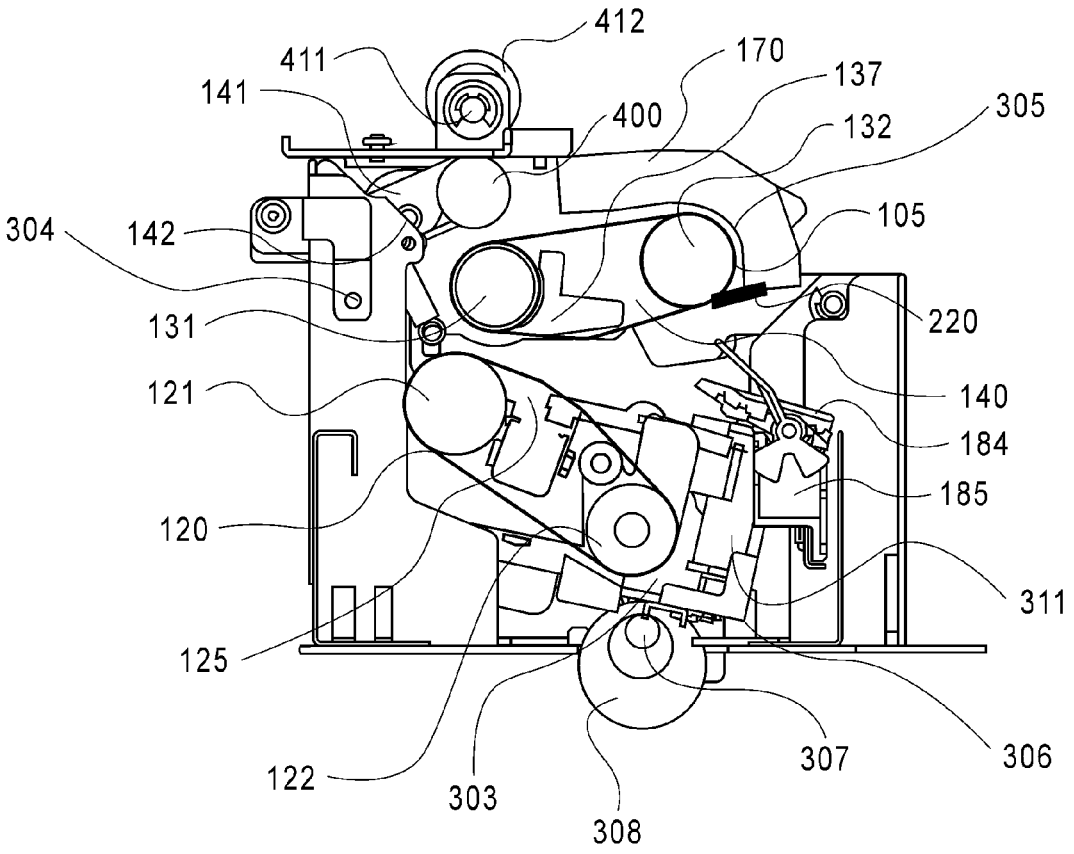
(57) **ABSTRACT**

An image heating apparatus includes: first and second rotatable members configured to heat an image on a sheet at a nip; a roughening member configured to perform roughening of a surface of the first rotatable member when at least the first rotatable member of the first and second rotatable members rotates; a moving mechanism configured to move the roughening member relative to the first rotatable member so that the roughening member is movable between a contact position where the roughening member is contacted to the first rotatable member and a spaced position where the roughening member is spaced from the first rotatable member; an obtaining portion configured to obtain information indicating that the first rotatable member is new; and a controller configured to control the moving mechanism to perform the roughening upon obtaining of the information by the obtaining portion.

10 Claims, 14 Drawing Sheets

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141
400
132
305
304
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131
220
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140
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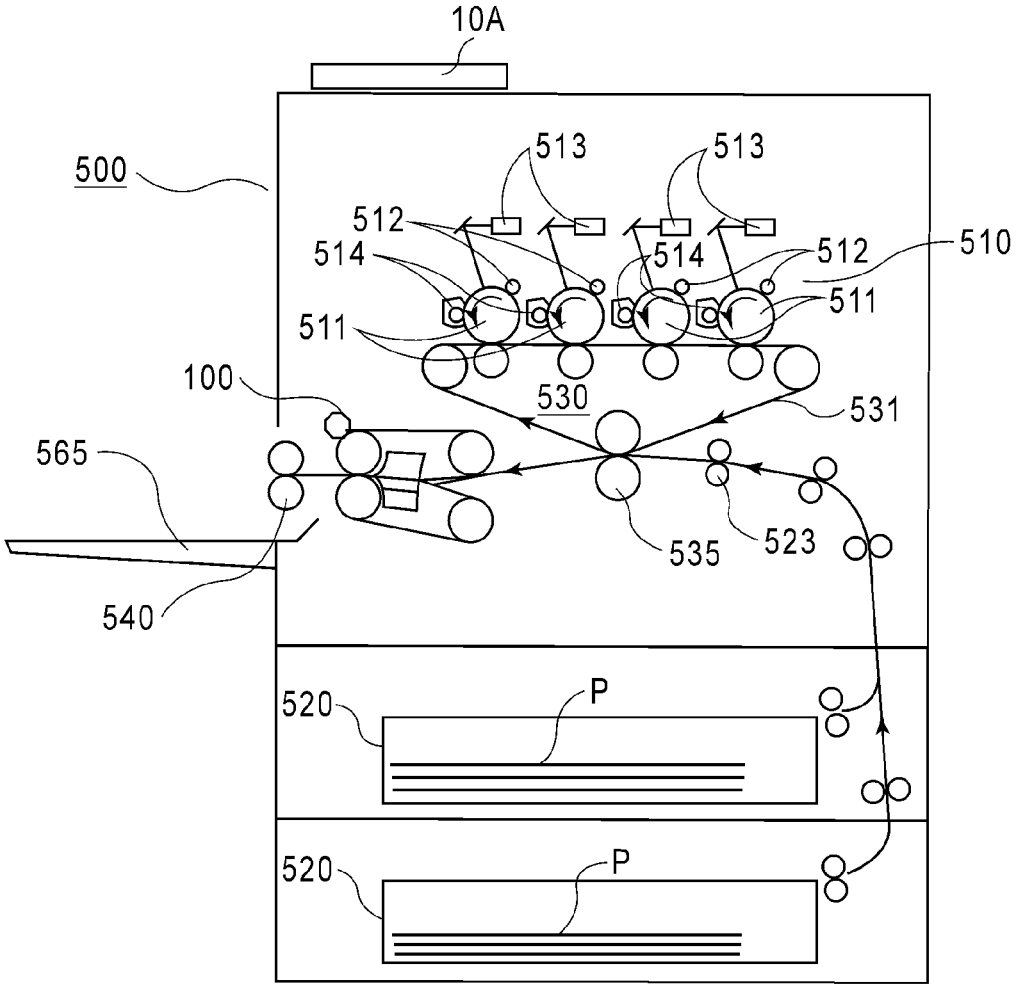
185
120
311
125
307
306
122
303
308

FIG.1


10A
500
513
513
512
514
514
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510
511
511
100
530
531
565
535
523
540
520
P
520
P

FIG.2

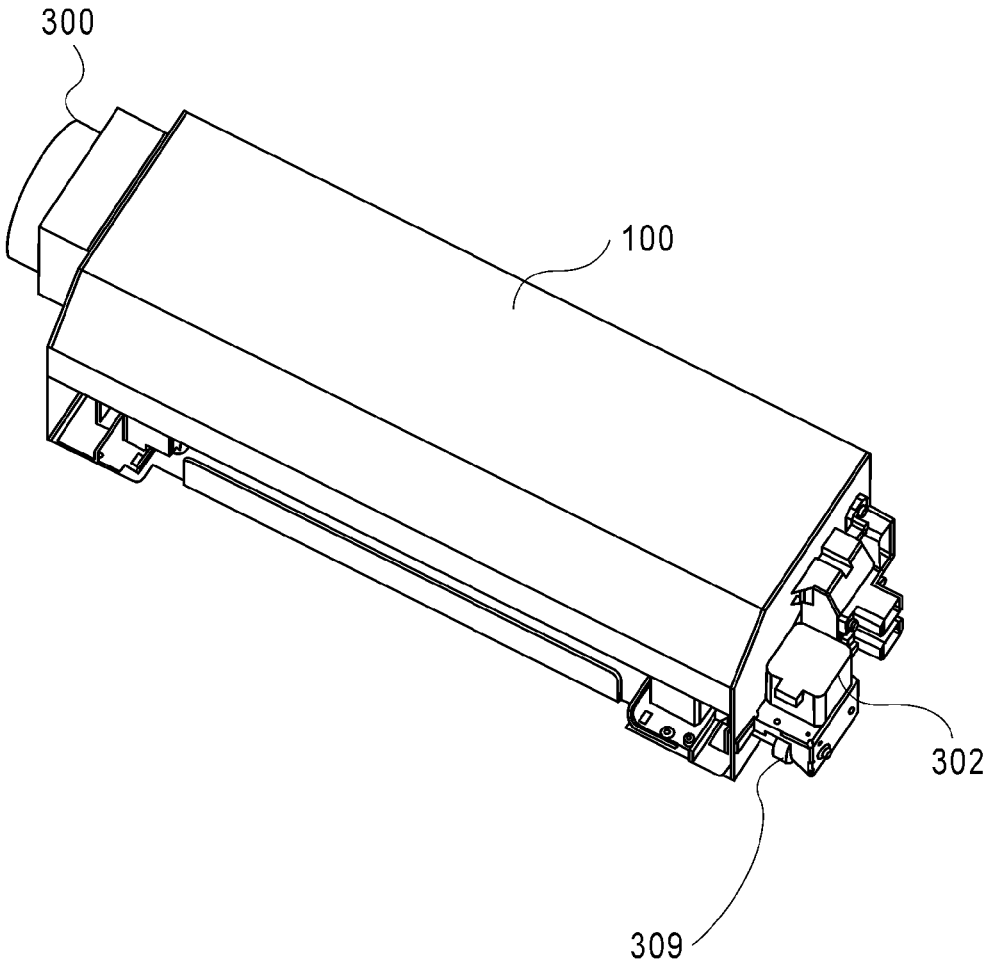


FIG.3

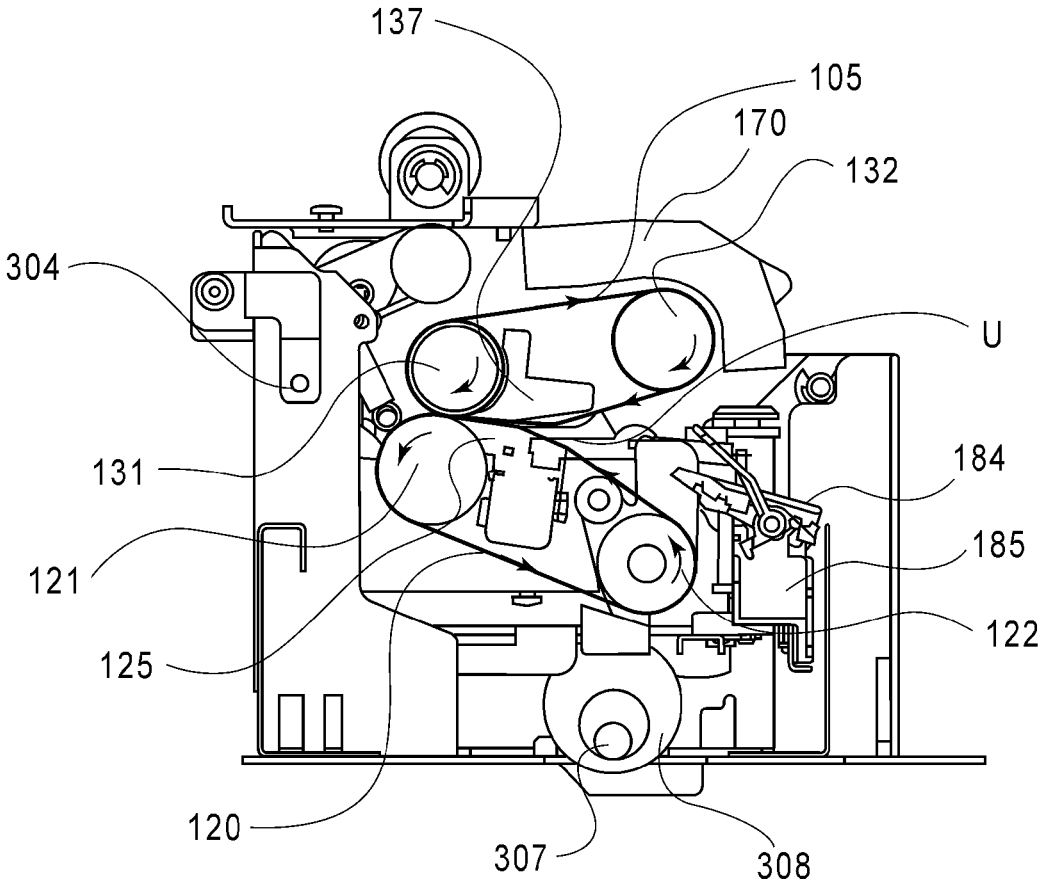


FIG.4

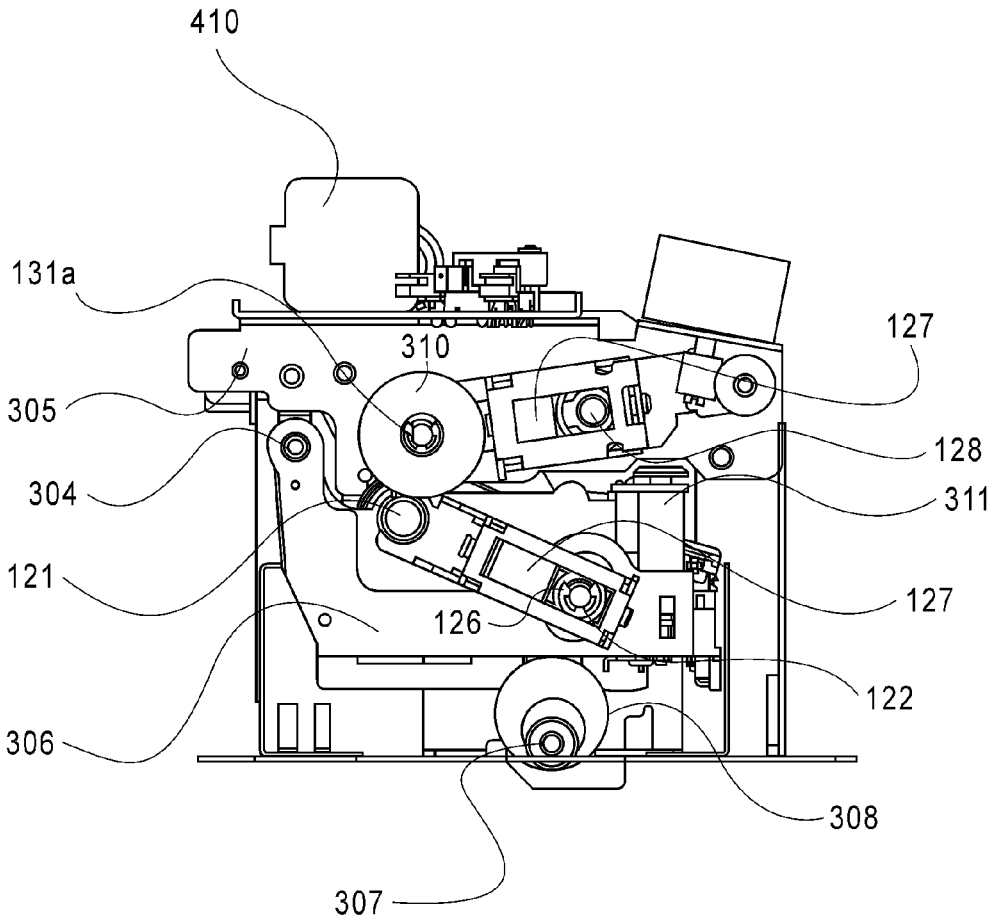


FIG.5

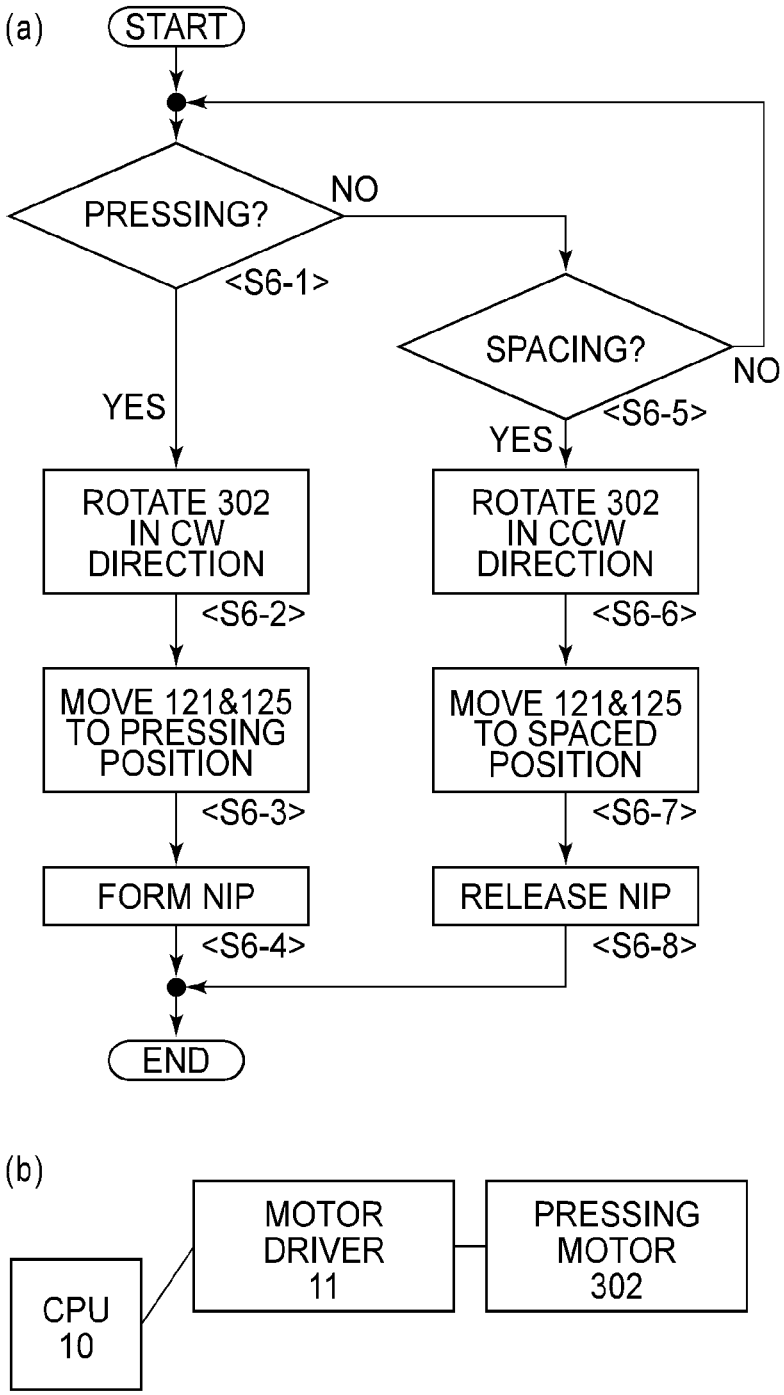

(a)
START
PRESSING?
<S6-1>
NO
YES
SPACING?
<S6-5>
NO
YES
ROTATE 302 IN CW DIRECTION
<S6-2>
ROTATE 302 IN CCW DIRECTION
<S6-6>
MOVE 121&125 TO PRESSING POSITION
<S6-3>
MOVE 121&125 TO SPACED POSITION
<S6-7>
FORM NIP
<S6-4>
RELEASE NIP
<S6-8>
END
(b)
CPU 10
MOTOR DRIVER 11
PRESSING MOTOR 302

FIG.6

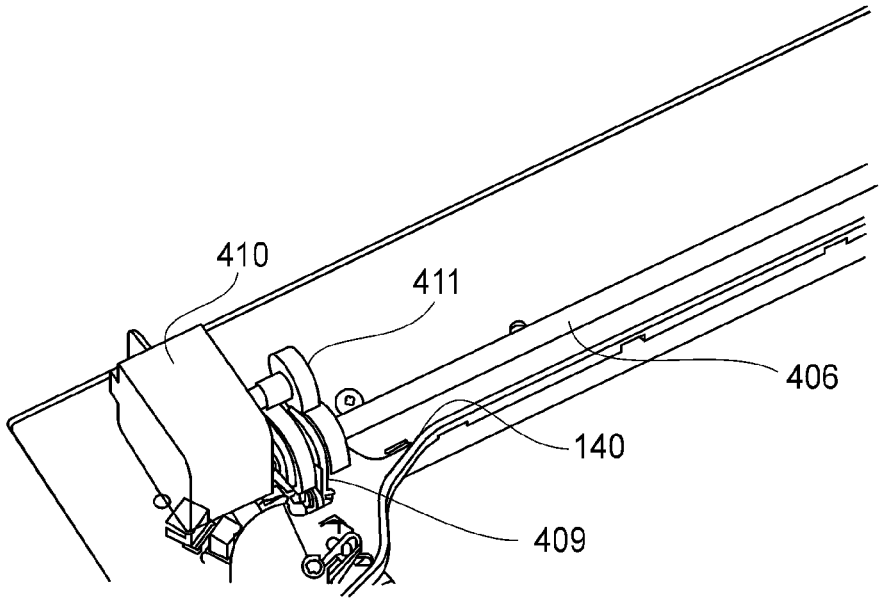

410
411
406
140
409

FIG.7A

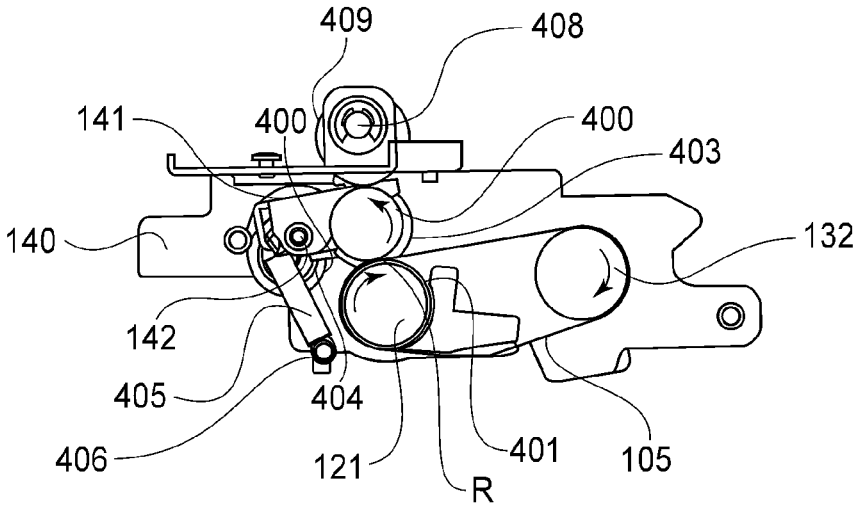

409
408
141
400
400
403
140
132
142
405
404
406
121
401
105
R

FIG.7B

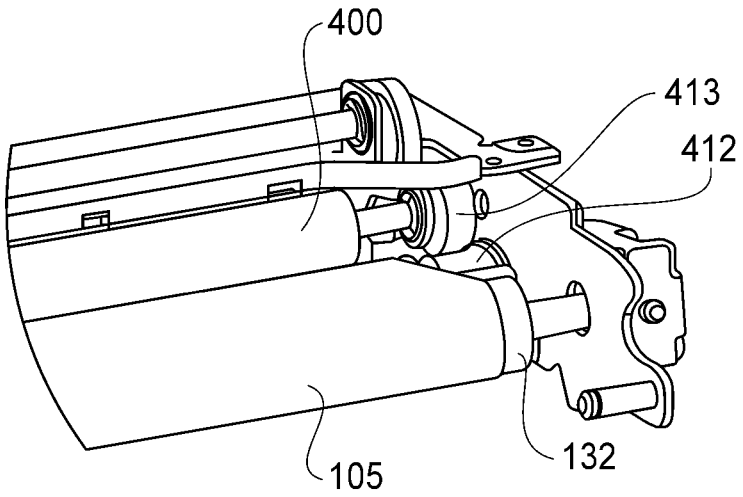


FIG.7C

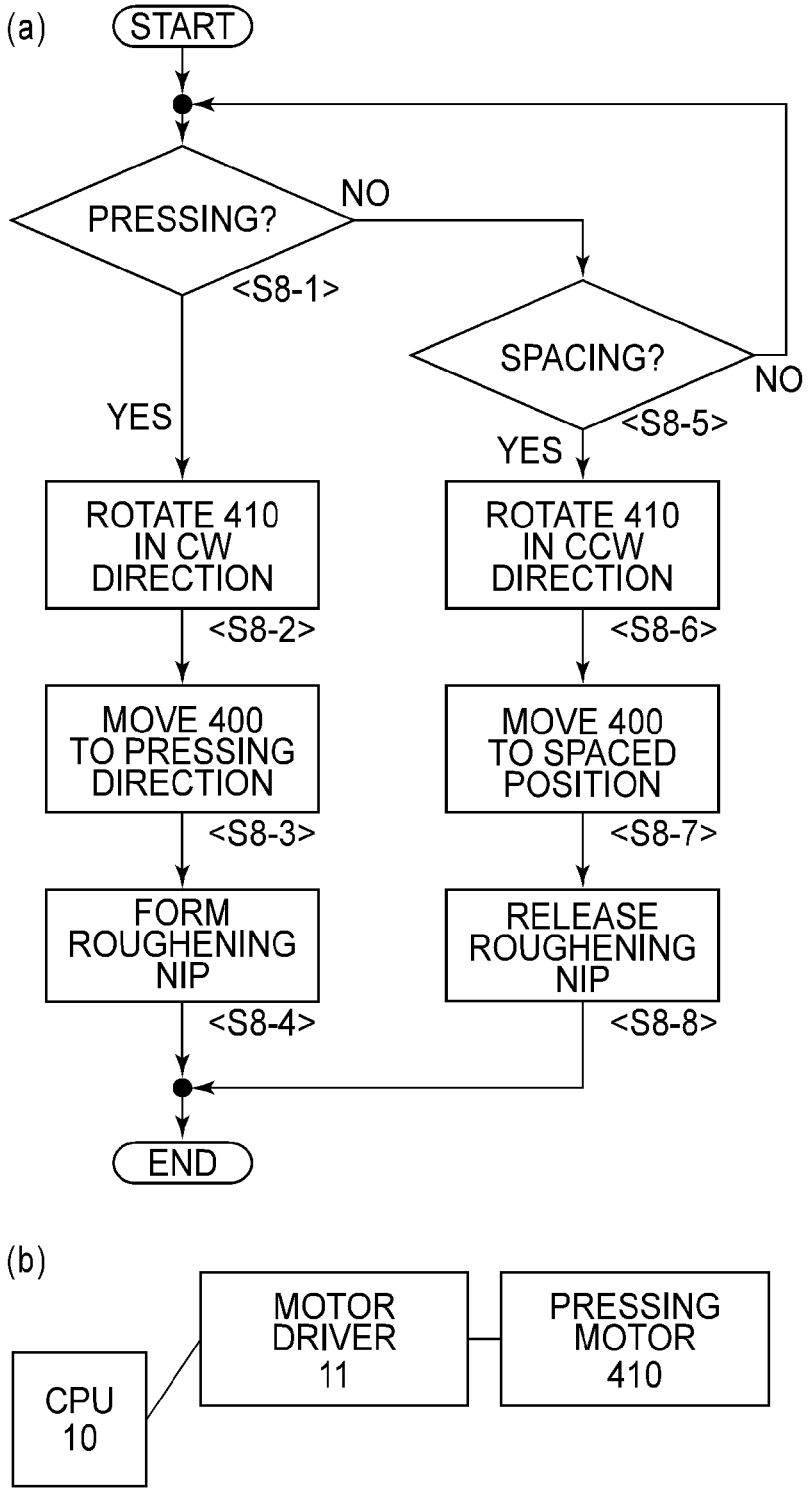

(a)
START
PRESSING?
NO
<S8-1>
YES
SPACING?
NO
<S8-5>
YES
ROTATE 410 IN CW DIRECTION
<S8-2>
MOVE 400 TO PRESSING DIRECTION
<S8-3>
FORM ROUGHENING NIP
<S8-4>
ROTATE 410 IN CCW DIRECTION
<S8-6>
MOVE 400 TO SPACED POSITION
<S8-7>
RELEASE ROUGHENING NIP
<S8-8>
END
(b)
CPU 10
MOTOR DRIVER 11
PRESSING MOTOR 410

FIG.8

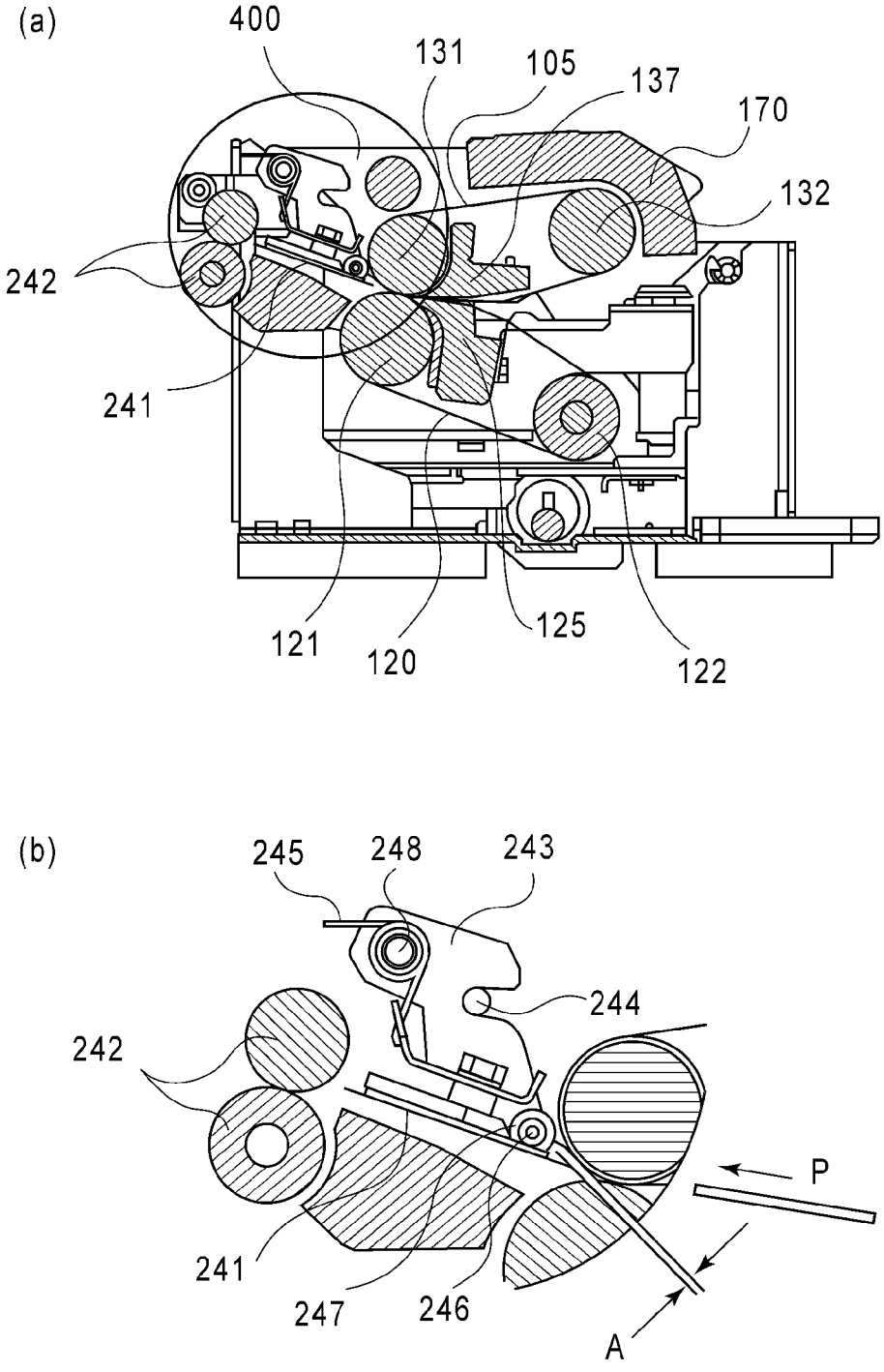

(a)
400
131
105
137
170
132
242
241
121
120
125
122
(b)
245
248
243
244
242
241
247
246
P
A

FIG.9A

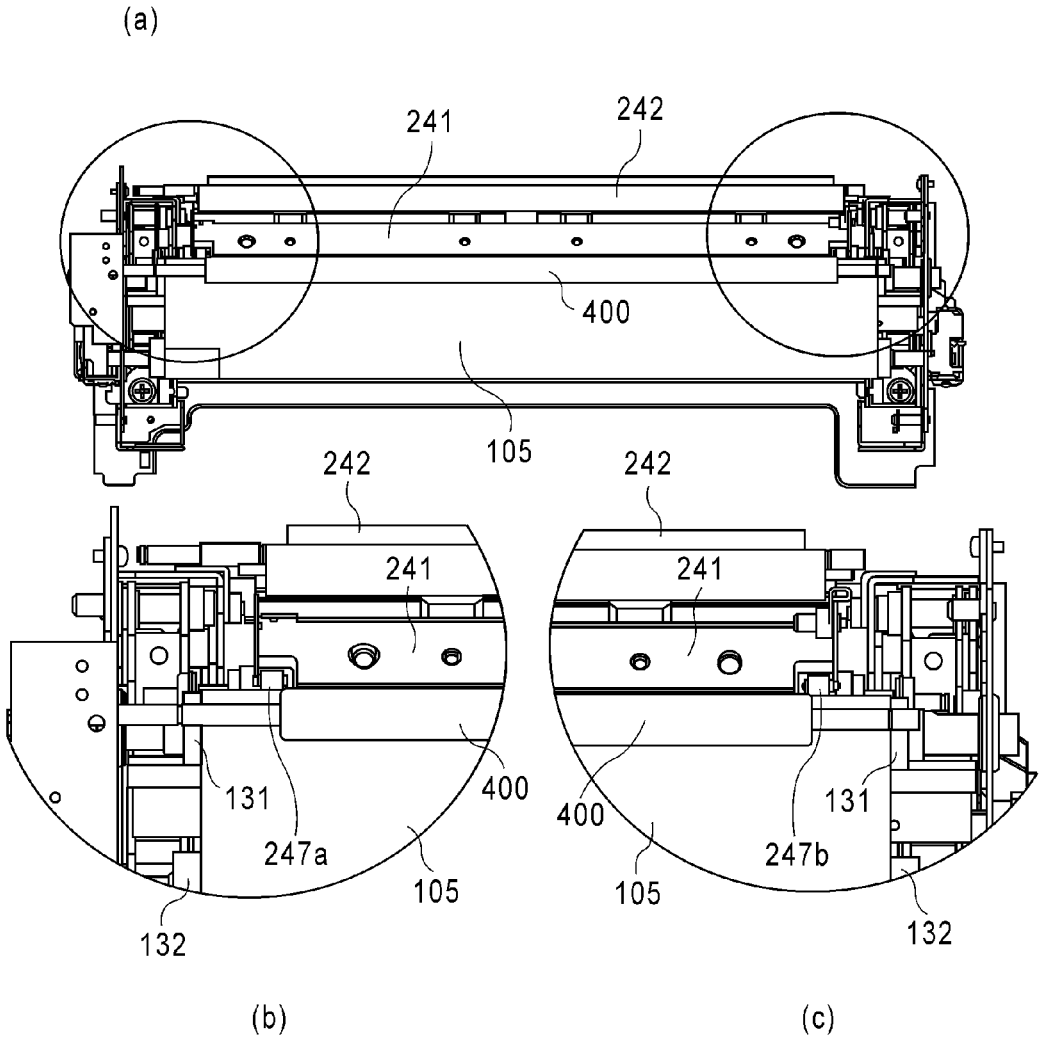
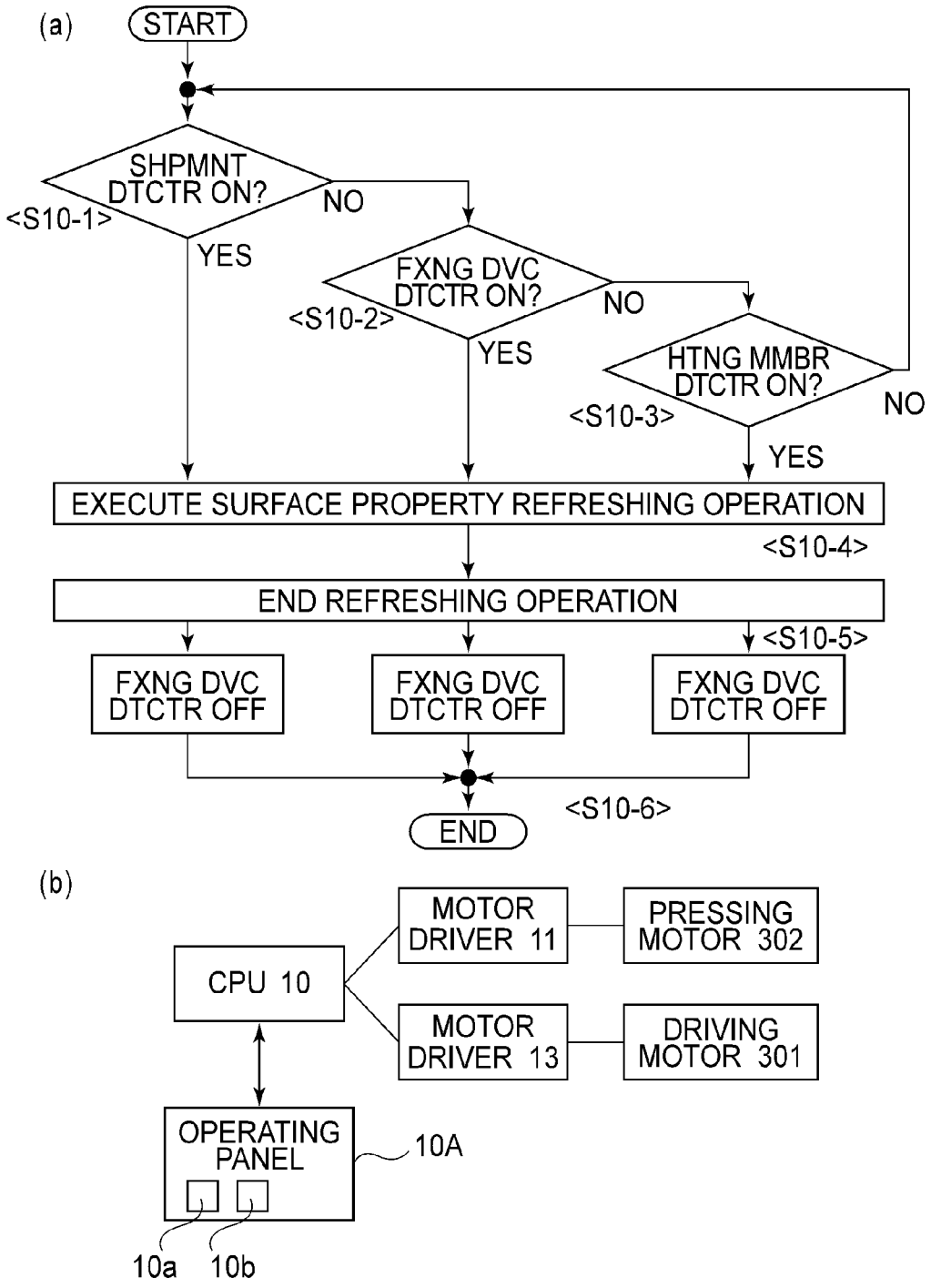

(a)
241
242
400
105
242
241
131
247a
400
105
132
(b)
242
241
400
131
247b
105
132
(c)

FIG.9B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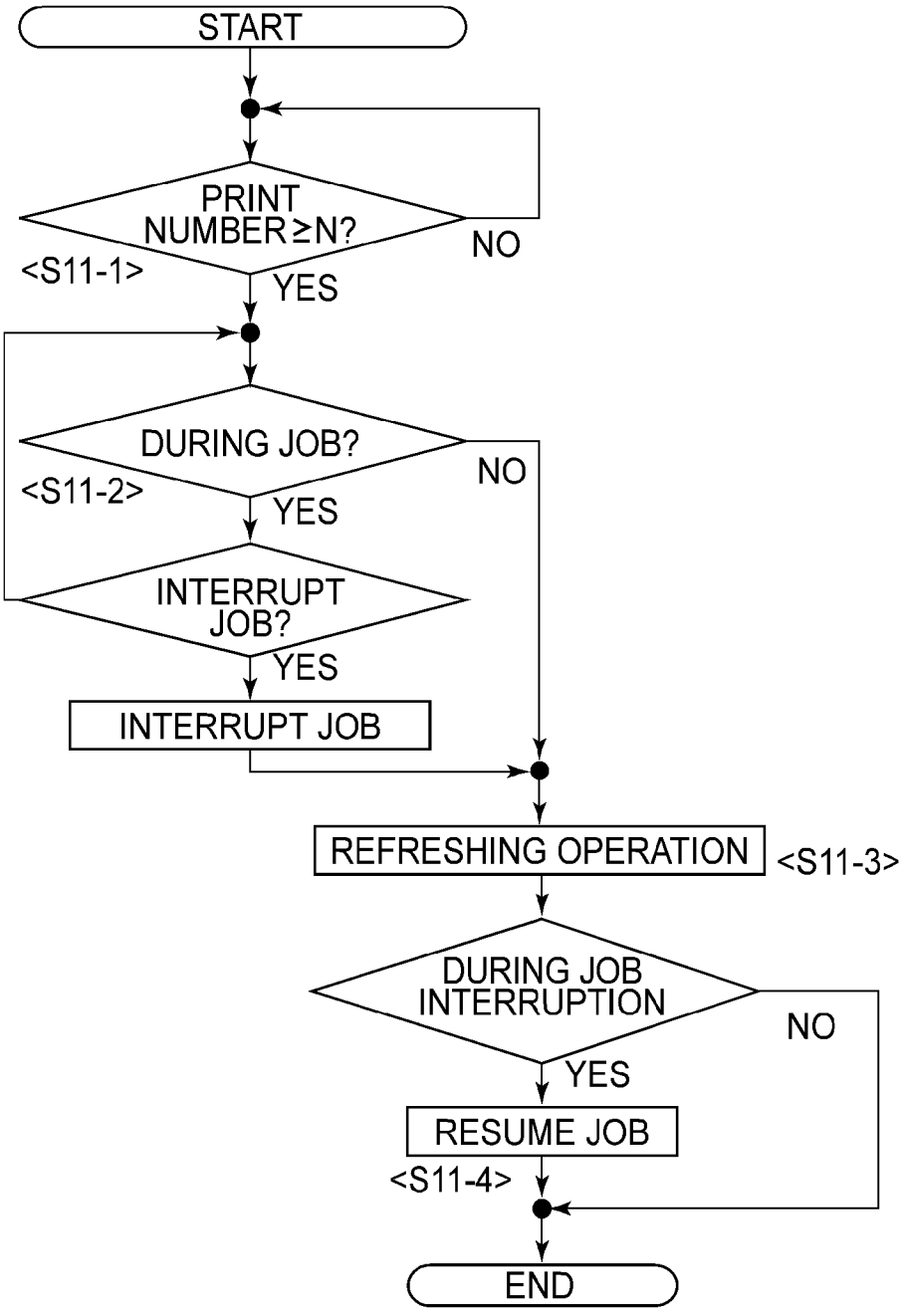
START
SHPMNT DTCTR ON?
<S10-1>
NO
YES
FXNG DVC DTCTR ON?
<S10-2>
NO
YES
HTNG MMBR DTCTR ON?
<S10-3>
NO
YES
EXECUTE SURFACE PROPERTY REFRESHING OPERATION
<S10-4>
END REFRESHING OPERATION
<S10-5>
FXNG DVC DTCTR OFF
FXNG DVC DTCTR OFF
FXNG DVC DTCTR OFF
<S10-6>
END
(b)
CPU 10
MOTOR DRIVER 11
PRESSING MOTOR 302
MOTOR DRIVER 13
DRIVING MOTOR 301
OPERATING PANEL
10A
10a
10b

FIG.10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DURING JOB?
NO
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YES
INTERRUPT JOB?
YES
INTERRUPT JOB
REFRESHING OPERATION
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DURING JOB INTERRUPTION
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YES
RESUME JOB
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END

FIG.11A

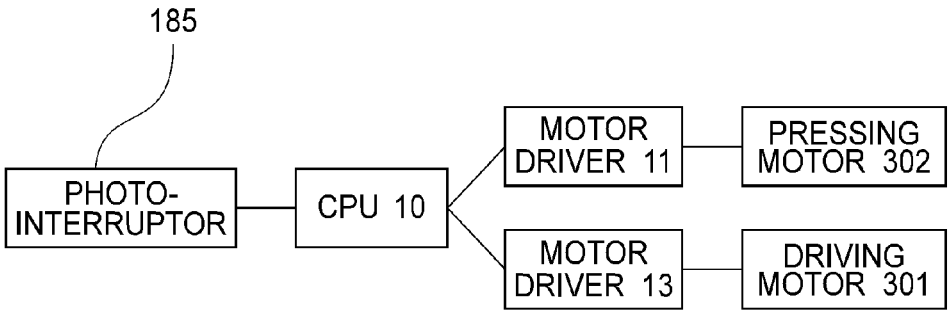
185
PHOTO-INTERRUPTOR
CPU 10
MOTOR DRIVER 11
PRESSING MOTOR 302
MOTOR DRIVER 13
DRIVING MOTOR 301

FIG.11B

IMAGE HEATING APPARATUS

The present invention relates to an image heating apparatus for heating an image on a sheet. The image heating apparatus is used in an image forming apparatus such as a copying machine, a printer, a facsimile machine or a multi-function machine having a plurality of functions of these machines.

In a conventional image forming apparatus, a fixing device fixes the image on the sheet by heating and pressing a toner image formed on the sheet. One type of fixing device is a, fixing device of a type using a fixing roller as a rotatable heating member (Japanese Laid-Open Patent Application 2005-266785).

Japanese Laid-Open Patent Application 2005-266785 discloses a constitution for repairing a surface of the fixing device in the case where the surface of the fixing roller is roughened with use of the fixing device. Specifically, the fixing device includes a surface-shape improving member having a desired surface state required for a fixing roller surface, a supporting member for supporting the surface shape improving member, a solenoid, and a solenoid driving circuit for driving the solenoid. In the case where the fixing roller surface is roughened with the use of the fixing device, the fixing device controls the solenoid driving circuit to bring the surface-shape improving member into contact with the fixing roller surface, so that the fixing roller surface is repaired.

That is, in the fixing device disclosed in Japanese Laid-Open Patent Application 2005-266785, in the case where the roughness of the fixing roller surface is not a desired roughness, the fixing roller surface is repaired to have the desired roughness. For that reason, the fixing device can fix the image on the sheet at a desired image quality by the fixing roller having a desired surface roughness.

However, in some cases, the roughness of the fixing roller surface is not the desired roughness independently of roughening with the use of the fixing device. For example, even when the fixing device is in a brand-new condition, there is a liability that the roughness of the fixing roller surface is not the desired roughness.

Specifically, there is a case where a foreign matter contacts the fixing roller surface during transportation of the fixing device. In the case where the image forming apparatus is initially disposed or in the case where the fixing device is exchanged, the device (apparatus) assembled in a factory is transported. During the transportation, in the case where an unexpected force is applied to the device, there is a liability that a member not normally in with the fixing roller during transportation, e.g., a separating plate for assisting with separation of the sheet from the fixing roller, contacts the fixing roller surface. When the fixing roller surface is damaged by the contact with the separating plate, the roughness thereof is not the desired roughness.

In this way, in the case where the fixing of the image on the sheet is performed using the fixing device in which the roughness of the fixing roller surface is not the desired roughness, there is a liability that the image does not have a desired quality and an image defect is generated.

SUMMARY OF THE INVENTION

A principal object of the present invention is to provide an image heating apparatus capable of supporting generation of an image defect.

According to an aspect of the present invention, there is provided an image heating apparatus comprising: first and second rotatable members configured to heat an image on a sheet at a nip; a roughening member configured to perform roughening of a surface of the first rotatable member when at least the first rotatable member of the first and second rotatable members rotates; a moving mechanism configured to move the roughening member relative to the first rotatable member so that said roughening member is movable between a contact position where the roughening member is contacted to the first rotatable member and a spaced position where the roughening member is spaced from the first rotatable member; obtaining means configured to obtain information indicating that the first rotatable member is a new one; and control means configured to control the moving mechanism to perform the roughening upon obtaining of the information by the obtaining portion.

These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an illustration showing a cross-section of a fixing device in an embodiment.

FIG. **2** is an illustration showing a cross-section of an image forming apparatus in the embodiment.

FIG. **3** is a perspective view showing an outer appearance of the fixing device in the embodiment.

FIG. **4** is an illustration showing a side surface of the fixing device in the embodiment.

FIG. **5** is an illustration showing a side surface of the fixing device in the embodiment.

In FIG. **6**, (a) is a flowchart for illustrating a fixing nip forming operation in the embodiment, and (b) is a block diagram of a constitution relating to the fixing nip forming operation in the embodiment.

FIG. **7**A-**7**C are schematic views for illustrating a roughening nip forming mechanism, wherein FIG. **7**A is a partially perspective view, FIG. **7**B is a partially sectional view, and FIG. **7**C is a partially perspective view.

In FIG. **8**, (a) is a flowchart for illustrating a fixing nip forming operation in the embodiment, and (b) is a block diagram of a constitution relating to control of the fixing nip forming operation in the embodiment.

In FIG. **9**A, (a) is a sectional view showing a constitution at a periphery of a separating member, and (b) is a partly enlarged view of (a).

In FIG. **9**B, (a) is a top view showing the constitution at the periphery of the separating member, (b) is a partly enlarged view of (a), and (c) is a partly enlarged view of (a).

In FIG. **10**, (a) is a flowchart for illustrating control of a surface property refreshing operation in the embodiment, and (b) is a block diagram of a constitution relating to the control of the surface property refreshing operation in the embodiment.

FIG. **11**A is a flowchart for illustrating the control of the surface property refreshing operation in the embodiment, and FIG. **11**B is a block diagram of a constitution relating to the control of the surface property refreshing operation in the embodiment.

DESCRIPTION OF THE EMBODIMENTS

Embodiment 1

(1) Image Forming Portion

FIG. **2** is a schematic structural view of a color electrophotographic printer **500**, which is an example of an image form-

ing apparatus, and is a sectional view of the printer **500** in this embodiment along a feeding direction of a sheet (recording material) P as a recording medium.

An image forming portion **510** of this printer **500** includes four photosensitive drums **511**, which are arranged in a tandem manner, for forming toner images (images) of colors of Y (yellow), M (magenta), C (cyan) and Bk (black), respectively.

A toner image forming operation performed by the image forming portion **510** is performed in the following manner. First, each of the photosensitive drums **511** is electrically charged by a charging roller **512**. Thereafter, each photosensitive drum **511** is exposed to light by a laser scanner **513**, so that a latent image is formed. The respective latent images are developed by developing devices **514** into toner images of the respective colors. The toner images on the respective photosensitive drums **511** are successively superposed on an intermediary transfer belt **531** of an intermediary transfer unit **530**, thus being primary-transferred. As a result, unfixed four color toner images are synthetically formed on the intermediary transfer belt **531**. As each of the toners, a toner enhanced in melting property by incorporating a parting agent (paraffin wax or the like) in the toner is used.

On the other hand, the sheet P is fed in the following manner. The sheets P are fed one by one from a first or second feeding cassette **520** and are sent to a registration roller pair **523**. The registration roller pair **523** once stops the sheet P passing therethrough, and rectifies the orientation of the sheet P so as to correct the inclination of the sheet P in the case where the sheet P is inclined and moved. Then, the registration roller pair **523** feeds the sheet P between the intermediary transfer belt **531** and a secondary transfer roller **535** in synchronism with the toner images on the intermediary transfer roller **531**.

Thus, when the toner images are fed between the intermediary transfer belt **531** and the secondary transfer roller **535**, and the color toner image on the intermediary transfer belt **531** is transferred on the sheet P by the secondary transfer roller **535**. Thereafter, the toner image on the sheet P is fixed on the sheet P by being heated and pressed in a fixing device **100**. Then, the sheet P on which the toner image is fixed is fed and discharged as a color image-formed product by a discharging roller pair **540** onto a discharge tray **565** provided at a side portion of the printer.

(2) Fixing Device

(2-1) Basic Structure

In this embodiment, the fixing device **100** is a device of an electromagnetic induction heating belt type and an oil-less fixing type. FIGS. **1** and **4** are cross-sectional views of the fixing device **100**, and FIG. **3** is a perspective view of the fixing device **100**. FIG. **5** is an illustration of a belt tension mechanism in the fixing device **100**.

A fixing belt **105** is a rotatable heating member for heating the image in contact with an image carrying surface of the sheet (recording material) P in a nip U described later. An IH heater (magnetic flux generating means) **170** is a heating source provided in the neighborhood of the surface of the fixing belt **105** in order to heat the fixing belt **105**, and is disposed above the fixing belt **105** in this embodiment.

The IH heater **170** includes a holder for holding an exciting coil and a magnetic core. The exciting coil generates AC magnetic flux by an AC current, and the AC magnetic flux generates an eddy current in the fixing belt **105**, which is an induction heat generation member by being introduced into the magnetic core. The eddy current generates Joule heat by the specific resistance of the induction heat generating member. The fixing device **100** in this embodiment supplies the AC current to the coil so that the surface temperature of the fixing belt **105** is about 150° C. In the fixing device **100** in this embodiment, the surface temperature of the fixing belt **105** is obtained on the basis of output information of a thermistor **220** for detecting the surface temperature of the fixing belt **105**.

A pressing belt **120** is a nip forming member for forming a fixing nip (nip portion) U, for nipping and feeding the sheet P, in cooperation with the fixing belt **105**. The pressing belt **120** is extended and stretched around a pressing roller **121** and a tension roller **122**, which are two supporting rollers, so as to be capable of being circulated and rotated. The tension roller **122** has the function of imparting tension to the pressing belt **120**, so that a predetermined tension (e.g., 200N) is applied to the pressing belt **120**.

A member used for the pressing belt **120** may appropriately be selected if the member has a heat-resistant property. As the pressing belt **120**, e.g., a belt member is used that is prepared by coating a 300 μm-thick silicone rubber on a nickel metal layer of 50 μm in thickness, 380 mm in width and 200 mm in circumferential length and then by coating a PFA (perfluoroalkoxyalkane) tube as a surface layer.

The fixing belt **105** is an endless belt member extended and stretched around a driving roller **131** and a tension roller **132**, which are two supporting rollers, so as to be capable of being circulated and rotated. The tension roller **132** has the function of imparting tension to the fixing belt **105**, so that a predetermined tension (e.g., 200N) is applied to the fixing belt **105**.

As the fixing belt **105**, a member may appropriately be selected if the member is caused to generate heat by the IH heater **170** and has the heat-resistance property. As the fixing belt **105**, a member is used that is prepared by coating a 300 μm-thick silicone rubber (elastic layer) on a magnetic metal layer (substrate) such as a nickel layer or a stainless steel layer of 75 μm in thickness, 380 mm in width and 200 mm in circumferential length and then by coating the PFA tuber as a surface layer.

Inside the pressing belt **120**, a pressing pad **125** for forming an upstream portion (entrance portion) of the fixing nip U with respect to a sheet feeding direction is provided. The pressing pad **125** contacts an inner surface of the pressing belt **120**. As the pressing pad **125**, an elastic member such as a silicone rubber is used.

Further, inside the pressing belt **120**, the pressing roller **121** for forming a downstream portion (exit portion) of the fixing nip U with respect to the sheet feeding direction is provided. As the pressing roller **121**, e.g., a solid roller formed of stainless steel and 20 mm in outer diameter can be used.

End portions of the tension roller **122** are supported by bearings **126**, and the tension of 20 kgf is applied to the pressing belt **120** by tension springs **127**. The tension roller **122** is a hollow roller and is formed of, e.g., stainless steel, to have an outer diameter of about 20 mm and an inner diameter of about 18 mm.

Inside the fixing belt **105**, a pad stay **137** for forming an upstream portion (entrance portion) of the fixing nip U with respect to the sheet feeding direction is provided. The pad stay **137** contacts the fixing belt **105**. The pad stay **137** is a member formed of, e.g., stainless steel (SUS material).

The driving roller **131** is roller formed by integral molding of a solid metal core formed of stainless steel and having an outer diameter of 18 mm with a heat-resistant silicone rubber elastic layer. The driving roller **131** is disposed so as to from an exit portion (downstream portion) of the fixing nip U. The

driving roller **131** can elastically deform the elastic layer by a predetermined amount in the case where the driving roller **131** is press-contacted to the fixing belt **105** toward the pressing roller **121** via the pressing belt **120**.

The tension roller **132** is a hollow roller formed of, e.g., stainless steel, to have an outer diameter of about 20 mm and an inner diameter of about 18 mm. The tension roller **132** is supported at end portions by bearings **128** and is pressed against the fixing belt **105** by tension springs **127**, so that the tension of 20 kgf is applied to the fixing belt **105**. The tension roller **132** in this embodiment has the function of adjusting meandering of the fixing belt **105** with respect to a widthwise direction perpendicular to a movement direction of the fixing belt **105**.

A driving motor **300** (FIG. **3**) is a driving means for rotating the fixing belt **105** by inputting a drive force (driving force) into a drive inputting gear **310** fixed on a shaft **131***a* (FIG. **5**) of the driving roller **131**. In this embodiment, the driving motor **300** is disposed outside the fixing device **100**.

The fixing device **100** in this embodiment controls the rotational speed of the driving motor **300**, thus controlling the feeding speed of the fixing belt **105** at two levels. One is a feeding speed Va during fixing in which the sheet P is nipped and fed through the fixing nip U and the image is fixed on the sheet P. The other is a feeding speed Vb used during rising of the image forming apparatus **500**. During the rising, the temperature of the fixing belt **105** is heated up to a target temperature (150° C.) or maintained at the target temperature before the timing of the fixing operation. In this case, the fixing belt **105** is heated by the IH heater **170** while being rotated, so that a full circumference of the fixing belt **105** can be uniformly heated.

In order to improve productivity of the fixing operation, it is desirable that the feeding speed Va is made higher. On the other hand, the feeding speed Vb for maintaining the temperature of the full circumference of the fixing belt **105** to be uniform is not required to be a speed corresponding to the feeding speed Va. In this embodiment, the rotational speed of the driving motor is 3000 rpm at the feeding speed Va and is 300 rpm at the feeding speed Vb.

An upper frame **305** is a member for rotatably supporting the driving roller **131** and includes an upper plate **140** for holding an end portion of the pad stay **137**. A lower frame **306** is a member for rotatably supporting the pressing roller **121** and includes a lower plate **303** for holding an end portion of the pressing pad **125**. Alternatively, the lower frame **306** is rotatably supported by a hinge shaft **304** provided on the lower plate **303**.

The lower frame **306** is constituted so as to movable between a pressing position shown in FIG. **4** and a spaced position shown in FIG. **1** by rotation of a pressing cam **308** provided at each of end portions of a pressing cam shaft **307**. The pressing cam shaft **307** is rotated by driving a pressing motor **302** (FIG. **3**) to operate a pressing gear **309**.

At the pressing position shown in FIG. **4**, the fixing belt **105** and the pressing belt **120** contact each other to form the fixing nip U. Specifically, the fixing belt **105** and the pressing belt **120** are sandwiched in an upstream side of the fixing nip U between the pad stay **137** and the pressing pad **125**. The fixing belt **105** and the pressing belt **120** are sandwiched in a downstream side between the driving roller **131** and the pressing roller **121**. To the fixing nip U, a predetermined pressure (e.g., 400N) is applied by the pressing springs **311**.

A forming operation of the fixing nip U by movement of the pressing roller **121** and the pressing pad **125** will be described using a flowchart and a block diagram shown in (a) and (b) of FIG. **6**, respectively.

The fixing device **100** effects control relating to the forming operation of the fixing nip U by a printer controller (control means: CPU) **10**.

In the case where the fixing nip U is formed, the CPU **10** provides a pressing instruction to a motor driver **11** <S**6-1**>. After receiving the pressing instruction from the CPU **10**, the motor driver **11** rotates the pressing motor **302** (FIG. **3**) in the clockwise (CW) direction by a predetermined number (N) of rotations <S**6-2**>. When driving of the pressing motor **302** is transmitted to the pressing cam shaft **307** by the pressing gear **309**, the lower frame **306** is pushed up by the pressing cam shaft **307**. Then, the pressing pad **125** and the pressing roller **121**, which are supported by the lower frame **306**, are moved to a pressing position <S**6-3**>. By the movement of the pressing pad **125** and the pressing roller **121** to the pressing position, the fixing belt **105** and the pressing belt **120** are press-contacted to each other, so that the fixing nip U is formed <S**6-4**>.

In the case where the formation of the fixing nip U is eliminated, the CPU **10** provides a spacing instruction to the motor driver **11**<S**6-5**>. After receiving the spacing instruction from the CPU **10**, the motor driver **11** rotates the pressing motor **302** (FIG. **3**) in the counterclockwise (CCW) direction by a predetermined number (N) of rotations <S**6-6**>. When driving of the pressing motor **302** is transmitted to the pressing cam shaft **307** by the pressing gear **309**, the lower frame **306** is supported at a lower position by the pressing cam shaft **307**. Then, the pressing pad **125** and the pressing roller **121**, which are supported by the lower frame **306**, are moved to a spaced position <S**6-7**>. As a result, the fixing nip U is eliminated <S**6-8**>.

During formation of the image at the image forming portion **510** of the printer **500**, the fixing device **100** is in a stand-by state in a state in which the fixing nip U is formed by causing the fixing belt **105** and the pressing belt **120** to press-contact each other. In the stand-by state, the fixing device **100** rotationally drives the fixing belt **105** and the pressing belt **120** in arrow directions by the drive of the driving roller **131**. Further, the fixing device **100** controls the temperature of the fixing belt **105** by using the IH heater **170** so as to be a predetermined temperature (fixing temperature).

When the sheet P on which the unfixed toner image is carried is fed from the secondary transfer roller **535** side, the fixing device **100** nips and feeds the sheet P in the fixing nip U.

The sheet P carrying the toner image is, in a process in which the sheet P is nipped and fed through the fixing nip U, heated by heat of the fixing belt **105** and pressed by a pressing force between the fixing belt **105** and the pressing belt **120**. Thus, the image is fixed on the sheet. That is, the fixing belt **105** and the pressing belt **120** constitute a pair of rotatable members for heating the image on the sheet P at the nip. At this time, the fixing belt **105** functions as one of the rotatable members. Then, the sheet P coming out of the fixing device **100** is fed and discharged onto the discharge tray **565** by the discharging roller pair **540** as described above.

(2-2) Roughening Mechanism

Referring to FIGS. **1** and **7**A and **7**B, a roughening mechanism for performing refreshing of a surface property of the fixing belt **105** will be described. The roughening roller **400** is a member rotatably supported by an RF supporting arm **141** via a bearing. The RF supporting arm **141** is a member rotatably supported by a fixing shaft **142** on a side plate **140**. The roughening roller **400** is driven by an RF driving gear **401** fixed at an end portion of the driving roller **131** and an RF gear

403 fixed at an end portion of the roughening roller **400**, and is rotated in a direction opposite to the rotational direction of the fixing belt **105**.

The RF supporting arm **141** supports the roughening roller **400** at one end portion and holds an RF spacing spring **405** at the other end portion. The RF spacing spring **405** is held by an RF spacing shaft **406**. The RF supporting arm **141** is urged toward an RF cam **407** by the RF spacing spring **405**. The RF cam **407** is fixed on an RF cam shaft **408**. On the RF cam shaft **408**, an RF mounting and demounting gear **409** is fixed. When the RF pressing motor **410** rotates, the RF cam shaft **408** is rotated via an RF motor gear **411**. In this way, the RF supporting arm **141** is moved upward and downward in accordance with a profile of the RF cam **407**, so that the roughening roller **400** moves between the pressing position (contact position) for forming a roughening nip R and a spaced position.

In this embodiment, in the case where the roughening roller **400** is in the pressing position, the roughening roller **400** contacts a full widthwise belt region of an upper portion of the fixing belt **105** in a region where the fixing belt **105** is supported by (wound around) the driving roller **131**. That is, the driving roller **131** functions as a back-up member for bringing the roughening roller **400** and the fixing belt **105** into contact with each other.

At a shaft end portion of the driving roller **131**, a roughening roller driving gear **412** is provided, and at a shaft end portion of the roughening roller **400**, a roughening roller driving gear **413** is provided. When the roughening roller **400** is press-contacted to the surface of the fixing belt **105**, the roughening roller driving gears **412** and **413** are engaged with each other. Thus, the roughening roller **400** to which the drive of the driving roller **131** is transmitted is rotated in a direction opposite to the rotational direction of the fixing belt **105**.

That is, the roughening roller **400** rotates the same direction (in which the surfaces of the roughening roller **400** and the fixing belt **105** move in the same direction) as the fixing belt **105** at the roughening nip (contact roller) R with a predetermined peripheral speed difference. The roughening roller **400** has an abrasive layer at the surface thereof and is capable of rubbing the fixing belt surface by contact thereof with the surface of the fixing belt **105**. Accordingly, by the rotation of the roughening roller **400** in the same direction as the fixing belt **105**, the roughening roller **400** is capable of roughening (leveling) the surface of the fixing belt **105** uniformly to have a desired roughness. That is, the roughening roller **400** executes a roughening operation (roughening process) for roughening the surface of the fixing belt **105** to the desired roughness, by the contact thereof with the rotating fixing belt **105**.

The surface roughness of the fixing belt **105** is influenced by a difference (peripheral speed difference) between surface speeds of the fixing belt **105** and the roughening roller **400**. That is, when the surface speed difference is small, the surface roughness of the fixing belt **105** becomes small, and when the surface speed difference is large, the surface of the fixing belt **105** becomes large. In this embodiment, in order to provide the fixing belt **105** with a desired roughness, the roughening operation is executed in a state in which the surface speed difference is 90 mm/s. In this embodiment, the ratio between the roughening roller driving gears **412** and **413** is 1.3:1, and in this state, the driving motor is rotated at 3000 rpm.

The roughening roller **400** has a constitution in which abrasive grains are closely bonded toward a surface of a metal core, formed of stainless steel and of 12 mm in diameter, via an adhesive layer. That is, the roughening roller **400** has a layer of the abrasive grains at the surface thereof. As the abrasive grains, those of #1000 to #4000 can be properly selected in accordance with a use (target glossiness of the image). The average particle size of abrasive grains **93***b* is 16 μm in the case of #1000 and is 3 μm in the case of #4000. The abrasive grains are alumina-based abrasive grains (so-called "alundum" or "molundum"). The alumina-based abrasive grains are most widely used and are considerably high in hardness compared with the surface of the fixing belt **105**, and are excellent in abrasive property since the abrasive grains have an acute shape.

In the case where the roughening operation is performed using the roughening roller **400** in the above-described condition, the surface of the fixing belt **105** can be roughened to have a surface roughness Rz of 0.5 μm or more and 1.0 μm or less. When the fixing belt **105** having such a roughness is incorporated in the fixing device **100** and is used for the fixing, an image defect due to the surface roughness of the fixing belt **105** does not appear. That is, an image having a proper glossiness can be fixed on the sheet P.

A flowchart and block diagram which show a pressing operation of a pressing mechanism for the roughening roller **400** used in this embodiment are shown in (a) and (b) of FIG. **8**, respectively.

The fixing device **100** controls the pressing operation by control of the CPU **10**.

In the case where the roughening nip R is formed, the CPU **10** provides a pressing instruction to a motor driver **12** <S**8**-**1**>. After receiving the pressing instruction from the CPU **10**, the motor driver **12** rotates the RF pressing motor **410** in the clockwise (CW) direction by a predetermined number (M) of rotations <S**8**-**2**>. Then, driving of the pressing motor **410** is transmitted to an RF cam shaft by the RF mounting and demounting gear **409**, so that the roughening roller **400** supported by the RF supporting arm **141** is moved to a pressing position (contact position) <S**8**-**3**>. When the roughening roller **400** is moved to the pressing position, the fixing belt **105** and the roughening roller **400** are press-contacted to each other, so that the roughening nip R is formed <S**8**-**4**>.

In the case where the formation of the roughening nip R is eliminated, the CPU **10** provides a spacing instruction to the motor driver **12**<S**8**-**5**>. The motor driver **12** receiving the spacing instruction from the CPU **10** rotates the RF pressing motor **410** in the counterclockwise (CCW) direction by a predetermined number (M) rotations <S**8**-**6**>. Then, the roughening roller **400** supported by the RF supporting arm **141** is moved to the spaced position <S**8**-**7**>, so that the roughening nip R is eliminated <S**8**-**8**>. That is, the RF supporting arm **141**, the RF spacing spring **405**, the RF spacing shaft **406**, the RF cam **407**, the RF cam shaft **408** and the pressing motor **410** function as a moving mechanism for moving the roughening roller **400** relative to the fixing belt **105** so that the roughening roller **400** is movable between the pressing position and the spaced position.

(2-3) Separating Plate

Referring to FIGS. **9**A, **9**B and **10**, a constitution of a separating plate **241** which is an auxiliary means for separating, from the fixing belt **105**, the sheet P coming out of the fixing nip U in the fixing device **100** will be described.

The separating plate **241** is provided closely to the fixing belt **105** in a sheet exit side of the fixing nip U so that an upstream end thereof with respect to the sheet feeding direction is in non-contact with the fixing belt **105**. The other end of the separating plate **241** functions as a guiding member for guiding the sheet P to a fixing-discharging roller pair **242** downstream thereof with respect to the sheet feeding direc-

tion. In this embodiment, a gap A between a free end (upstream end) of the separating plate **241** and the fixing belt **105** is 0.5 mm.

The separating plate **241** is supported by a separating plate holder **243**. The separating plate holder **243** is supported rotatably about a rotation center shaft **244** of the separating plate **241** at a widthwise end portion of the fixing belt **105**. Then, the separating plate holder **243** is urged in the counterclockwise direction about the center shaft **244** by a spring **245**. Then, the end of the separating plate **241** is urged in a direction in which the separating plate **241** approaches the fixing belt **105**. At end portions of the separating plate holder **243** with respect to a longitudinal direction, a shaft **246** and rollers **247***a* and **247***b* rotatably supported by the shaft **246** are independently provided in front and rear sides, respectively. Each of the rollers **247***a* and **247***b* is pressed with a predetermined pressing force (e.g., 0.03N) so as to contact the belt **105** by an urging force of the spring **245**. As a material for the rollers **247***a* and **247***b*, any material may be appropriately selected if the material has a heat-resistant property, and PFA can be used, for example.

(2-4) Surface Property Refreshing Operation Mode During Initial Disposition of Apparatus

Referring to FIG. **10**, a surface property refreshing operation mode of the fixing belt **105** by the roughening roller **400** during initial disposition of the image forming apparatus **500** will be described. In the following, of the image forming apparatus **500**, a group of constituent elements relating to image heating will be referred to as an image heating apparatus. That is, the image heating apparatus includes the CPU **10** and an operating panel **10**A described later in addition to the fixing device **100**.

When fixing devices **100** in a brand-new condition are shipped from a factory, the fixing devices **100** are transported to designations thereof. In this case, when an unexpected external force is applied to the fixing device **100** by vibration or the like during transportation, there is a liability that parts in the apparatus interfere with each other in response to receiving a shock (impact). Specifically, there is a liability that the separating plate **241** disposed closely to the surface of the fixing belt **105** in a non-contact state damages the surface of the fixing belt **105**. Then, even when the fixing belt **105** is in the brand-new condition, the surface of the fixing belt **105** does not have a desired roughness, so that it is difficult to output an image at a desired quality. Also in the following case, the surface of the fixing belt **105** in the brand-new condition does not have the desired roughness. For example, in the case where there is a defective portion in a roughening step of a manufacturing process of the fixing belt **105**, the fixing device **100** is shipped in some instances before the surface of the fixing belt **105** has the desired roughness. The influence on the image due to the surface roughness is not limited to that by the fixing belt **105**, but also the surface roughness of the pressing belt **120** has an influence on the image (particularly on double-side images). Accordingly, in the case where the surface of the pressing belt **120** is required to have the desired roughness, a surface roughening operation may be executed in the case where a roughening roller is provided in a pressing belt side and the pressing belt **120** is detected as being in a brand-new condition. That is, the rotatable member whose surface is roughened by the roughening roller **400** may also be the pressing belt **120**. Further, both the fixing belt **105** and the pressing belt **120** may also be surface-roughened by the roughening roller **400**. That is, at least one of the pair of rotatable members for forming the nip is the rotatable member to be surface-roughened by the roughening roller **400**. However, damage of the fixing belt **105** generated by the contact with the separating plate **241** has the largest influence on the image. The fixing device **100** functions as an exchange unit including the fixing belt **105** and the separating plate **241**.

Therefore, in the case where the fixing belt **105** in this embodiment is detected as being in brand-new condition, the surface roughening operation of the fixing belt **105** is executed. Specifically, in the case where the fixing belt **105** is exchanged, the fixing device **100** executes the surface roughening operation of the fixing belt **105**. Further, when the fixing device **100** used in the image heating apparatus is exchanged (replaced) with a fixing device **100** including the fixing belt **105** in a brand-new condition, the fixing device **100** executes the surface roughening operation of the fixing belt **105**. Further, in the case where the image heating apparatus in which is incorporated the fixing device **100** in the brand-new condition is initially disposed, the fixing device **100** executes the surface roughening operation of the fixing belt **105**.

Therefore, the image heating apparatus includes a detecting means for detecting that the image heating apparatus is initially disposed. That is, the image heating apparatus includes an obtaining means for obtaining information indicating that the image heating apparatus is initially disposed. The image heating apparatus further includes a detecting means for detecting that the fixing device **100** is exchanged. That is, the image heating apparatus includes an obtaining means for obtaining information indicating that the fixing device **100** is exchanged. Or, the image heating apparatus includes a detecting means for detecting that the fixing belt **105** is exchanged. That is, the image heating apparatus includes an obtaining means for obtaining information indicating that the fixing belt **105** is exchanged.

In the fixing device **100** in this embodiment, during initial shipping of the image heating apparatus, the timing when a shipping clear button **10***a* is pressed is used as a trigger for detection by using the pressing of the shipping clear button **10***a* at an operating panel (operating portion) **10**A of the image heating apparatus. That is, the trigger is turned on at a timing of the initial shipping of the image heating apparatus. Specifically, the operating panel **10**A outputs, to the CPU **10**, information indicating that the fixing device **100** (the fixing belt **105**) is in the brand-new condition.

Further, in the fixing device **100** in this embodiment, during exchange of the fixing device **100** with a fixing device **100** in a brand-new condition or during exchange of the fixing belt **105** with a fixing belt **105** in a brand-new condition, the timing when a counter reset button **10***b* is pressed is used as a trigger for detection by using the pressing of the counter reset button **10***b* for resetting the count of the number of times of use of the fixing belt **105** (i.e., the number of sheets subjected to the fixing or the number of sheets passing through the fixing nip U). That is, the trigger is turned on by the fixing device **100** at a timing of completion of the exchange of the fixing device **100** or the fixing belt **105**. Specifically, the operating panel **10**A outputs, to the CPU **10**, information indicating that the fixing device **100** (the fixing belt **105**) is in the brand-new condition.

The surface property refreshing operation will be described with reference to FIG. **10**.

In the case where the image heating apparatus is shipped, the image heating apparatus is transported to a disposing place while being kept in a detection trigger-ON state. Then, when a power source for the image heating apparatus is turned on for initial disposition, the CPU **10** checks that the trigger is in the ON state <**S10-1**>. That is, the CPU **10**

functions as an obtaining means for obtaining information indicating that the fixing device **100** (the fixing belt **105**) is in the brand-new condition.

In the case where the fixing device **100** in the brand-new condition is incorporated in the image heating apparatus for the exchange of the old fixing device **100**, the image heating apparatus prompts a user (operator) to press the counter reset button **10***b* after the mounting of the fixing device **100** is completed. Then, when the counter reset button **10***b* is pressed by the user (operator), the CPU **10** checks that the trigger is in the ON state <S**10**-**2**>. That is, the CPU **10** functions as an obtaining means for obtaining information indicating that the fixing device **100** (the fixing belt **105**) is in the brand-new condition.

In the case where the fixing belt **105** in the brand-new condition is incorporated in the image heating apparatus for the exchange of the old fixing belt **105**, the image heating apparatus prompts a user (operator) to press the counter reset button **10***b* after the mounting of the fixing device **100** is completed. Then, when the counter reset button **10***b* is pressed by the user (operator), the CPU **10** checks that the trigger is in the ON state <S**10**-**3**>. That is, the CPU **10** functions as an obtaining means for obtaining information indicating that the fixing device **100** is in the brand-new condition.

In either of the above-described conditions, when the trigger-ON state is confirmed, the CPU **10** executes an instruction for the surface property refreshing operation (roughening operation). That is, the CPU **10** functions as the obtaining means for obtaining the information indicating that the fixing device **100** (the fixing belt **105**) is in the brand-new condition from an output of the operating panel **10**A as an operating means. Further, in the case where the above information is obtained, the CPU **10** functions as a control means for controlling a moving mechanism so that the roughening roller **400** moves to the contact position.

The CPU **10** in this embodiment obtains the information showing that the fixing belt **105** is in the brand-new condition from the operating panel **10**A, but an obtaining source is not limited to the operating panel **10**A. For example, a detecting means such as a reading sensor for detecting the brand-new condition of the fixing belt **105** by reading an IC tag attached to the fixing belt **105** may also be used. Then, the CPU **10** may also execute the surface property refreshing operation of the fixing belt **105** depending on an output of the reading sensor.

By control of the CPU **10**, the surface property refreshing operation described above with reference to FIG. **8** is executed <S**10**-**4**>. The CPU **10** executes the surface property refreshing operation of the fixing belt **105** for a predetermined time. The predetermined time for which the surface property refreshing operation is executed may desirably be a time of at least one rotation of the fixing belt **105**.

When an ending condition is satisfied, the CPU **10** ends the surface property refreshing operation <S**10**-**5**>. Then, the CPU **10** turns off the trigger for the initial shipping of the image forming apparatus **500**, the exchange of the fixing device **100** with the fixing device **100** in the brand-new condition or the exchange of the fixing belt **105** with the fixing belt **105** in the brand-new condition <S**10**-**6**>. In this way, the fixing device **100** is in a state in which the fixing is executable, and the CPU **10** is in a stand-by state for a print job. That is, the CPU **10** moves the roughening roller **400** to the contact position in a period from the detection that the fixing device **100** is in the brand-new condition until the fixing is executed. Then, the CPU **10** maintains the roughening roller **400** at the contact position in a period from the movement of the roughening roller **400** to the contact until the fixing belt **105** rotates at least one full turn. Then, the CPU **10** moves the roughening roller **400** from the contact position to the spaced position in a period until the fixing is executed.

In this way, in this embodiment, in the fixing device including the roughening member for roughening the surface of the fixing belt **105**, the roughening operation of the fixing belt **105** by the roughening member is executed in the case where the fixing device **100** is in the brand-new condition. For that reason, even when the surface of the fixing belt **105** in the fixing device **100** in the brand-new condition does not have a desired roughness by, e.g., contact of the separating plate **243** with the surface of the fixing belt **105** during transportation, a high-quality image can be formed stably from an initial stage of the execution of the fixing.

(2-5) Surface Property Refreshing Operation Mode During Fixing

In the above, the surface property refreshing operation of the fixing belt **105** during the detection of the brand-new condition of the fixing device **100** was described. In this embodiment, also during the execution of the fixing, the surface property refreshing operation of the fixing belt **105** is performed. For that reason, referring to FIG. **11**, the surface property refreshing operation of the fixing belt **105** by the roughening member **400** during the fixing will be described.

The sheet P on which the toner image is formed by the photosensitive drum **511** and the transfer roller **535** and which is fed to the fixing device **100** is guided by an entrance guide **184** provided on the lower frame **124**, and thereafter enters the fixing nip U. The entrance guide **184** is provided with a flag sensor **185** including a photo-interrupter, and the flag sensor **185** detects timing of passing of the sheet P.

The sheet P on which the toner image is fixed by being heated and pressed in the fixing nip U is discharged through the fixing nip U. Thereafter, the sheet P is fed and discharged onto the discharge tray **565** by the discharging roller pair **540**.

The CPU **10** counts the number of sheets P subjected to the fixing, and in the case where a predetermined number N of sheets P is subjected to the fixing, after the printing operation, the surface property refreshing operation of the fixing belt **105** by the roughening member **400** is performed for a predetermined time.

The surface property refreshing operation will be described with reference to FIG. **11**. After the fixing of the predetermined number of sheets, when the CPU **10** provides a control instruction for the surface property refreshing operation <S**11**-**1**>, after end of the print job or interruption of the print job <S**11**-**2**>, the surface property refreshing operation is started <S**11**-**3**>. When the surface property refreshing operation is ended after a lapse of a predetermined time from the start thereof, the interrupted print job is resumed <S**11**-**4**> or the CPU **100** is in a stand-by state for the print job.

In this embodiment, the fixing device **100** executing the surface property refreshing operation after the fixing of the predetermined number of sheets was described. However, the fixing device **100** may also execute the surface property refreshing operation on the basis of a count, of the number of sheets subjected to the fixing, performed only in the case where the image is fixed on specific sheets P. Further, the fixing device **100** may also execute the surface property refreshing operation before the print job of the specific sheets P. Or, the fixing device **100** may also perform the surface property refreshing operation of the fixing belt **105** by an operation of the user through the operating panel **10**A.

However, in either case, the surface property refreshing operation is not executed on the basis of the detection of the brand-new condition of the fixing device **100**.

Other Embodiments

(1) In the present invention, the image forming portion **510** of the image forming apparatus **500** is not limited to that of the electrophotographic type. Image forming apparatuses for forming the unfixed toner images on the sheets P by using other known transfer-type or direct-type image forming principles or types such as an electrostatic recording type and a magnetic recording type may also be used.

(2) The image forming apparatus is not limited to the color image forming apparatus, but may also be a monochromatic (single-color) image forming apparatus for forming a monochromatic image or the like, in which a single image bearing member (photosensitive drum or the like) is provided.

(3) In this embodiment, as the fixing device **100**, the fixing device **100** in which the fixing belt **105** and the pressing belt **120** are the belt members was described, but a similar effect can also be obtained even when the present invention is applied to a fixing device in which both are roller members or a fixing device in which either one is the belt.

(4) It is also possible to employ a device constitution in which the nip forming members (pressing member and opposing member) for forming the nip U in combination with the fixing belt **105** are non-rotatable members. That is, it is possible to employ a device constitution in which the nip forming members are non-rotatable members such as a pad member, a plate-like member and the like which have smooth surfaces having small friction efficiency with the pressing member **105** or the sheet P.

(5) The heating means for the rotatable heating member **105** and the nip forming member **120** is not limited to the electromagnetic induction heating means. The heating means can also have a device constitution employing proper heating means or heating type, such as a halogen heater, a ceramic heater or an infrared lamp, which heat the rotatable heating member **105** or the nip forming member **120** from an inside or an outside.

(6) The image heating apparatus is not limited to that having such a constitution in which the unfixed toner image is fixed on the sheet by using the fixing device **100**. The image heating apparatus may also have a constitution in which the toner image once or temporarily fixed on the sheet is heated again to modify glossiness or the like by using a glossing device.

While the invention has been described with reference to the structures disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or changes as may come within the purpose of the improvements or the scope of the following claims.

This application claims the benefit of Japanese Patent Application No. 2014-102159 filed on May 16, 2014, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. An image heating apparatus comprising:

first and second rotatable members configured to heat an image on a sheet at a nip;

a roughening member configured to perform roughening of a surface of said first rotatable member when at least said first rotatable member of said first and second rotatable members rotates;

a moving mechanism configured to move said roughening member relative to said first rotatable member so that said roughening member is movable between a contact position where said roughening member is contacted to said first rotatable member and a spaced position where said roughening member is spaced from said first rotatable member;

obtaining means configured to obtain information indicating that said first rotatable member is new; and

control means configured to control said moving mechanism to perform the roughening upon obtaining of the information by the obtaining means.

2. An image heating apparatus according to claim **1**, wherein said control means controls said moving mechanism so that the roughening is performed in a period from the obtaining of the information by said obtaining means until heating of the image on the sheet is executed.

3. An image heating apparatus according to claim **2**, wherein said control means controls said moving mechanism to move said roughening member from the contact position to the spaced position in a period from movement of said roughening member to the contact position, depending on the obtaining of the information by said obtaining means, until image heating is executed.

4. An image heating apparatus according to claim **1**, wherein said control means maintains said roughening member at the contact position during at least one rotation of said first rotatable member after said roughening member is moved to the contact position, depending on the obtaining of the information by said obtaining means.

5. An image heating apparatus according to claim **1**, wherein said roughening member roughens the surface of said first rotatable member to have a surface roughness of 0.5 μm or more and 1.0 μm or less.

6. An image heating apparatus according to claim **5**, wherein said roughening member has a layer of abrasive grains at a surface thereof, and the abrasive grains have an average particle size of 3 μm-16 μm.

7. An image heating apparatus according to claim **6**, wherein said roughening member is a roughening roller rotatable in a direction opposite to a rotational direction of said first rotatable member.

8. An image heating apparatus according to claim **1**, further comprising operating means operable by an operator,

wherein said operating means outputs the information to said obtaining means when a predetermined operation is performed.

9. An image heating apparatus according to claim **1**, further comprising a separating member, provided adjacent to the surface of said first rotatable member, configured to separate the sheet from said first rotatable member,

wherein said first rotatable member and said roughening member are provided in a unit detachably mountable to said image heating apparatus, and

wherein said obtaining means obtains the information on the basis of said unit being in a brand-new condition.

10. An image heating apparatus according to claim **1**, wherein said first rotatable member is a rotatable heating member configured to heat the image on the sheet in contact with an image carrying surface of the sheet.

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